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VARIETY TESTS OF SUGARCANES IN LOUISIANA DURING THE CROP YEAR 1936-37 AND SUMMARY OF ANNUAL RESULTS, 1935-37

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INTRODUCTION

Investigations conducted by the United States Department of Agriculture in connection with the introduction of new varieties of sugarcane for cultivation in Louisiana include a comprehensive program of carefully controlled plantation-scale tests. The results of these tests, in addition to serving an essential purpose in providing a guide to breeding objectives, afford to growers information as to the advantages and limitations of newly introduced varieties under the various soil and climatic conditions. Results of such tests during the period 1926–34 have been summarized in annual circulars published by the Department. Results obtained during 1935 and 1936, including data on the two most recently introduced commercial varieties, C. P. 29/116 and C. P. 29/320,[2] have been reported elsewhere (*4*, *6*).[3] This report gives the results of tests during the crop year 1936–37, together with a summary of annual results during the last 3 years.

Yield data heretofore published have shown conclusively that the previously cultivated P. O. J. varieties cannot under any of the conditions involved compete with the more recently introduced C. P. and Co. varieties. Discussions and data presented in this report are therefore limited to varieties of the latter two groups, which are now cultivated to the practical exclusion of all others in the Louisiana sugarcane district.

[1] Acknowledgment is made to the Division of Soil Fertility Investigations, Bureau of Plant Industry, and to A. M. O'Neal, formerly of that Division, for valued cooperation in the phase of the investigation involving a study of the relation between soil type and varietal performance and in identifying the characteristic soil types of plots of land on which variety tests were carried on; to I. E. Stokes, assistant agronomist, Division of Sugar Plant Investigations, formerly stationed at Houma, La., who supervised the planting of all tests covered by this report; and to Lionel Harmon, agent, Division of Sugar Plant Investigations, who conducted all juice analyses.

[2] Many varieties of sugarcane are commonly designated by letters or other abbreviations indicating the origin of the seedling cane. The meanings of such designations for the varieties mentioned throughout this circular are as follows: Co. = Coimbatore (India) seedlings; C. P. = Canal Point (Fla.) seedlings; P. O. J. = Proefstation Oost Java seedlings; P. O. J. 36–M = Mingka selections of P. O. J. 36.

[3] Italic numbers in parentheses refer to Literature Cited, p. 25.

SEASONAL CONDITIONS

Prevailing temperatures during January and early February 1937 were unseasonably high and caused extensive vegetative growth, most of which was killed back as a result of freezing temperatures early in March.

Total rainfall (table 1) for the year was in general somewhat above normal, but the distribution was not entirely favorable. Throughout most of the district and particularly in the western parishes a rather serious drought occurred during late April and in May. The abnormally high rainfall during October was no doubt chiefly responsible for the unsatisfactory progress in the ripening of sugarcane quite generally noted during the early part of the harvest season. This condition was intensified in the coastal parishes as a result of extensive lodging of sugarcane caused by a windstorm on October 2.

TABLE 1.—*Distribution and amount of rainfall at seven sugarcane test fields in Louisiana during 1937*

Station	January		February		March		April		May		June		July	
	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches
Albania	9	8.73	5	2.02	8	9.30	4	7.75	0	0	7	3.75	7	4.06
Alma	10	7.74	5	3.87	8	12.50	8	6.48	8	8.25	2	2.07	8	6.99
Clovelly	6	4.10	7	4.82	9	4.63	3	2.92	2	3.90	9	13.75	9	3.84
Greenwood	7	5.80	2	2.25	8	4.05	3	4.80	2	3.60	7	4.10	5	2.95
Oaklawn	10	5.40	3	1.50	7	5.00	3	5.50	2	1.25	8	3.00	6	2.95
Raceland	7	4.00	5	3.25	7	4.05	5	7.47	2	.25	12	11.74	6	4.42
Houma	15	4.56	10	3.51	10	5.02	4	3.37	3	3.43	15	8.94	13	7.22
Normal for Houma [1]	----	4.02	----	4.37	----	3.70	----	3.89	----	3.83	----	6.05	----	8.56

Station	August		September		October		November		December		Total	
	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches
Albania	11	4.75	7	4.49	4	8.70	2	2.71	4	4.12	68	60.38
Alma	4	3.69	4	2.02	5	6.28	1	.78	6	4.15	69	64.82
Clovelly	10	4.87	9	2.96	11	20.70	3	1.45	3	1.47	81	69.41
Greenwood	11	8.25	4	4.47	7	8.45	4	1.63	7	4.45	67	54.80
Oaklawn	9	4.50	5	6.85	5	6.50	2	1.60	6	2.80	66	46.85
Raceland	12	8.43	5	1.97	10	20.60	4	1.37	5	3.80	80	71.35
Houma	13	5.03	9	2.72	10	12.44	4	1.52	8	3.49	114	61.25
Normal for Houma [1]	------	7.21	------	5.65	------	4.07	------	3.76	------	4.81	------	59.92

[1] Average precipitation during the period 1888–1920 (*14*).

On November 20 and 21, Weather Bureau temperatures (*15*) ranging from 25° to 29° F. occurred in the sugarcane district. At the Houma station where a minimum shelter temperature of 27° was recorded, sugarcane made no further progress in maturity after the freeze but showed no appreciable deterioration, as determined by periodic juice analyses. Extensive and rapid deterioration of standing cane of all varieties followed temperatures ranging from 22° to 25° on December 6 and 7.

DISEASE CONDITIONS [4]

In Louisiana the weather plays an important role each year in determining the yields of cane and sugar that are obtained with the commercial varieties of sugarcane, not only as a result of the effect of temperature and rainfall on the growth of the sugarcane plant itself, but also by their influence on the development of the various diseases to which this crop is subject. Of the major sugarcane diseases in the State, root rot and red rot in particular are affected by the weather, although it should be borne in mind that weather is but one of the several factors having a bearing on the prevalence of diseases and on the losses caused by them.

During the crop year 1937 the weather had an important bearing on injury by root rot, particularly on the susceptible varieties Co. 281 and C. P. 28/19. As pointed out by Rands and Abbott (*10*) in a discussion of stand losses of the latter variety, weather conditions during the late winter and early spring months were particularly favorable for the development of root rot. During February and March the seed root systems of C. P. 28/19 plant cane were so severely injured that many plants were unable to withstand the subsequent drought that began in April and continued into May, with the result that stands in many fields that had originally been satisfactory were seriously impaired by the dying out of the young plants not yet established on their own shoot roots. This condition occurred particularly in cane planted the previous October on mixed and heavy soils, although it was also evident on light soils. The effect of this reduction in stand and weakening of the young plants early in the season was undoubtedly reflected in reduced yields of cane of C. P. 28/19 and in some instances delayed maturity of Co. 281 in commercial fields in the fall (*10*).

The weather conditions that favored root rot in February and March were also favorable for red rot, although the year was not marked by serious losses in stands of cane from this disease alone. Deterioration of seed cane of C. P. 28/19 by both red rot and *Cytospora* rot occurred, however, in combination with the root rot injury already described. Except for isolated instances, injury by red rot to the other commercial varieties was probably not such as materially to affect the yields obtained in the fall.

PARENTAGE OF C. P. 29/116 AND C. P. 29/320 [5]

The parentage of C. P. 29/116 and C. P. 29/320, varieties bred by the United States Department of Agriculture and released in 1936 and 1935, respectively, for commercial culture in Louisiana, is shown in the following genealogical table.

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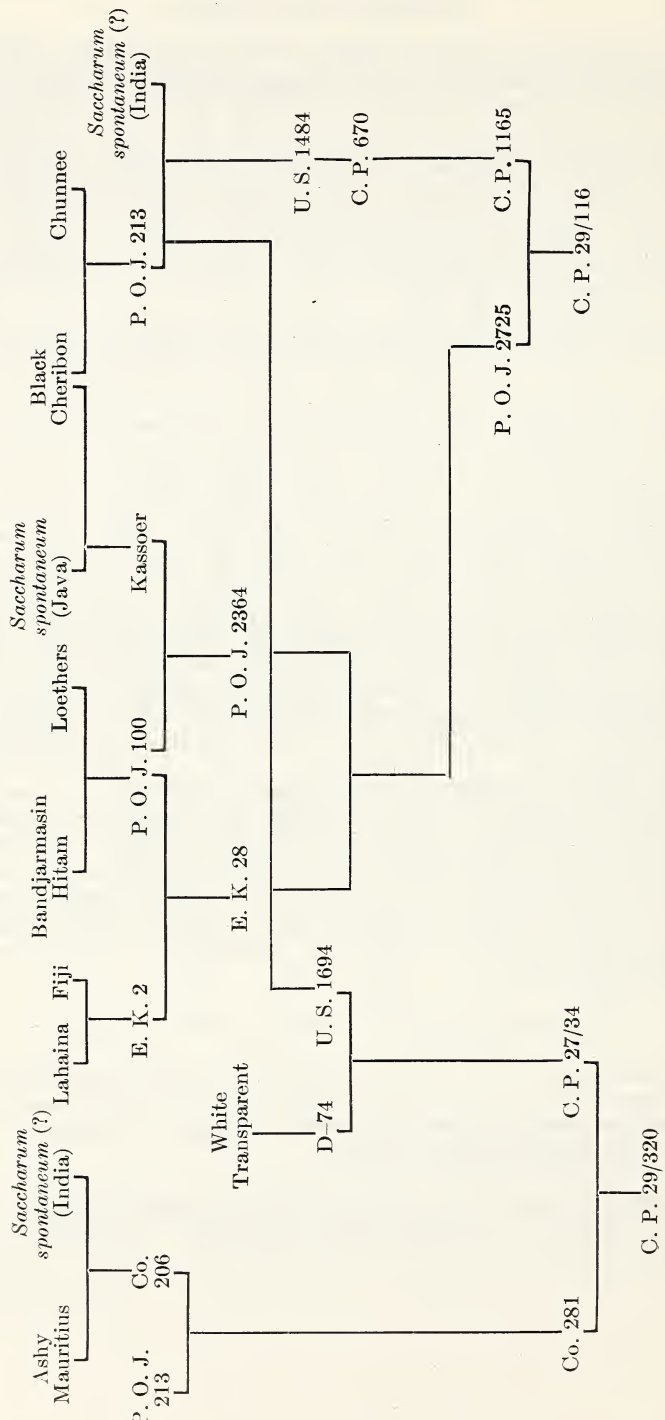
[4] Contributed by E. V. Abbott, associate pathologist, Division of Sugar Plant Investigations.
[5] Contributed by G. B. Sartoris, senior pathologist, Division of Sugar Plant Investigations.


Ashy Mauritius
Saccharum spontaneum (?) (India)
Lahaina
Fiji
Bandjarmasin Hitam
Loethers
Saccharum spontaneum (Java)
Black Cheribon
Chunnee
Saccharum spontaneum (?) (India)
P. O. J. 213
Co. 206
E. K. 2
P. O. J. 100
Kassoer
P. O. J. 213
White Transparent
E. K. 28
P. O. J. 2364
D-74
U. S. 1694
U. S. 1484
C. P. 670
Co. 281
C. P. 27/34
P. O. J. 2725
C. P. 1165
C. P. 29/116
C. P. 29/320

The varieties are species hybrids of *Saccharum officinarum*, *S. barberi*, and *S. spontaneum*. In the pedigree of C. P. 29/320 are the noble canes Ashy Mauritius, Black Cheribon (Louisiana Purple), and D–74, and Chunnee, a variety of *S. barberi*. *S. spontaneum* of India occurs twice in the lineage, entering through Co. 206 and U. S. 1694. The parentage of C. P. 29/116 is somewhat more complicated. In its pedigree are the noble varieties Lahaina, Fiji, Bandjarmasin Hitam, Loethers, and Black Cheribon, Chunnee, a variety of *S. barberi*, and two varieties of *S. spontaneum*, the *S. spontaneum* from Java entering through Kassoer and the *S. spontaneum* from India through U. S. 1484. The varieties C. P. 29/320 and C. P. 29/116 are related through U. S. 1694 and U. S. 1484, which are seedlings from the same progeny.

There is, however, some doubt regarding the ancestry of C. P. 29/116 and C. P. 29/320 because the male parents of Co. 206, U. S. 1484, and U. S. 1694 are not actually known. Co. 206 was one of a few narrow-leafed seedlings in a large progeny. It was therefore assumed to have arisen from a natural cross of Ashy Mauritius with *Saccharum spontaneum* (*16*).

U. S. 1484 and U. S. 1694 were from seed of P. O. J. 213 selfed, imported from Coimbatore, India. Their morphological and breeding characteristics, however, indicate that they possess qualities inherited from *Saccharum spontaneum*. It is assumed that the seed was of hybrid origin, because P. O. J. 213 is now known to be almost universally pollen sterile, and under the conditions at Coimbatore, pollination by *S. spontaneum* growing nearby was possible.

EXPERIMENTAL METHODS

Methods of plot technique, field sampling, and sugar-yield calculations have been described in previous publications (*3*, *5*). From four to six varieties were compared in group tests by means of the commonly employed "checkerboard" system of plot arrangement. The weights of from 6 to 12 plots, each usually comprising one-fortieth of an acre and distributed at random with Latin-square restrictions over the test area, supplied the basic data for computing the average yield of cane per acre for each variety in individual cases.

A 30-stalk sample of cane was taken from each plot and brought to the United States Sugar Plant Field Station near Houma for milling and juice analysis. Sugar-yield calculations according to the method described below were made from juice analyses of individual samples, thus affording a basis for making a statistical analysis of sugar-yield data. The yield of sugar per ton is based on the Winter-Carp formula, using the following milling and recovery factors: Assumed juice extraction, 76 percent; reduction factors to convert laboratory-mill analysis to the expected "normal juice" analysis, Brix, 0.985; sucrose, 0.970; boiling-house efficiency number=100 percent. Yields thus calculated are adjusted for differences in milling qualities between varieties by the application of the following "varietal correction factors" derived according to the method described in a previous publication (*3*):

(1) For C. P. 28/11 and C. P. 28/19, correction factor=0.96.
(2) For C. P. 807 and C. P. 29/320, correction factor=0.98.
(3) For Co. 281, C. P. 29/89, and C. P. 29/120, correction factor=1.00 (no correction).

(4) For C. P. 29/103 and C. P. 29/137, correction factor=1.02.
(5) For C. P. 29/116 and C. P. 29/131, correction factor=1.04.
(6) For Co. 290, D–95, C. P. 29/99, and C. P. 29/108, correction factor=1.06.

It will be noted that correction factors for C. P. 28/11, C. P. 28/19, and C. P. 29/320 are slightly lower than tentative ones previously given (*5*). Factors for the varieties Co. 281, Co. 290, C. P. 807, C. P. 28/11, C. P. 28/19, C. P. 29/116, and C. P. 29/320 are based on average results obtained in 20 or more milling tests extending over a period of several years and are not likely to be affected by the results of future tests. Those given for other varieties are based on much more limited data and must be regarded as tentative. Statements throughout this circular concerning sugar yields refer to indicated available 96° sugar calculated according to the foregoing methods.

Statistical calculations are based on the analysis-of-variance method described by Fisher (*7*). The significance of observed averages is expressed in terms of differences between comparable averages that correspond to the two commonly accepted levels of statistical significance, viz, for $P=0.05$ and for $P=0.01$. As a matter of chance alone, a difference corresponding to $P=0.05$ may be expected only 5 times and one corresponding to $P=0.01$ only once in 100 comparable trials. Differences of the latter order of magnitude are usually regarded as definitely significant.

TESTS ON LIGHT SOIL

The various test fields mentioned in this report are the sites of annually repeated variety tests and represent the principal soil types of the Louisiana sugar district. These are located as follows: United States Sugar Plant Field Station, Houma; Greenwood Plantation, Thibodaux; Godchaux Plantation, Raceland; Oaklawn Plantation, Franklin; Southwestern Louisiana Institute, Lafayette; Albania Plantation, Jeanerette; Roland Farm, Erath; Caldwell Plantation, Erath; Alma Plantation, Lakeland; Rosewood Plantation, Hamburg; Clovelly Plantation, Cut Off; and Leon J. Landry Plantation, New Iberia.

Tables 2, 3, and 4 give detailed results of the principal tests on light soils during 1937, and table 5 summarizes the average annual results obtained in such tests during 1935–37. The results of extensive tests with C. P. 29/116 and C. P. 29/320 are of special interest. Results obtained with C. P. 29/320 in particular are considered as possibly justifying some rather important readjustments in proportionate plantings of commercial varieties on soils of this class.

Results obtained with Co. 281 are in keeping with those previously obtained and published. Yields of sugar per acre from this variety have averaged approximately 1,000 pounds below those from C. P. 28/19. Co. 281, however, has proved to be the only entirely satisfactory variety for windrowing purposes now commercially available (*9*), and the planting of this variety to an extent sufficient to satisfy ordinary windrowing needs is generally considered a practical necessity at this time. The choice of well-drained light soil for this purpose is imperative for reasons of varietal adaptability and also in the interest of minimizing transportation difficulties during the ordinarily rainy period when windrowed cane must be harvested.

TABLE 2.—*Results of plant-cane variety tests on light soils in Louisiana during 1937*

[Harvested November 26 to December 13, inclusive]

Variety	Houma (2)	Greenwood [2]	Godchaux [2]	Oaklawn [2]	Southwestern Louisiana Institute [3]	Albania [2]	Roland Farm [3]	Alma [2]	Rosewood [3]	Average of 9 stations
AVERAGE YIELD OF CANE PER ACRE (TONS) [1]										
Co. 281	25.36	26.24	27.04	13.74	19.56	18.56	17.16	27.54	24.24	22.16
Co. 290	43.84	43.00	38.34	23.44	29.40	35.70	24.18	44.50	35.64	35.34
C. P. 28/11	29.87	26.96	22.56	18.76	23.25	23.94	17.34	30.00	27.64	24.48
C. P. 28/19	29.17	24.36	31.00	12.34	18.54	22.46	15.06	29.06	28.96	23.44
C. P. 29/116	41.81	40.90	39.64	31.56	31.05	31.96	28.26	40.76	38.50	36.05
C. P. 29/320	33.43	32.10	30.30	24.82	22.89	25.36	21.84	32.86	32.56	28.46
Difference for $P=0.05$ [4]	3.48	1.66	2.01	2.01	2.34	2.03	1.69	2.30	3.55	-------
Difference for $P=0.01$	4.75	2.21	2.68	2.69	3.19	2.72	2.30	3.07	4.85	-------
AVERAGE INDICATED YIELD OF 96° SUGAR PER TON OF CANE (POUNDS)										
Co. 281	169.8	131.5	142.3	155.6	160.1	195.5	180.5	174.4	151.3	[5] 160.8
Co. 290	163.7	111.8	134.2	174.3	130.3	155.3	166.1	146.4	128.8	[5] 143.7
C. P. 28/11	204.4	192.5	176.8	174.0	153.4	190.5	204.8	172.9	144.6	[5] 178.9
C. P. 28/19	203.5	194.7	166.7	179.1	191.8	206.9	215.1	196.4	163.5	[5] 189.3
C. P. 29/116	143.1	121.7	110.7	167.3	125.3	161.3	155.0	146.2	109.1	[5] 136.3
C. P. 29/320	191.9	155.8	148.8	177.4	168.1	200.9	200.6	192.4	167.2	[5] 177.3
Difference for $P=0.05$ [4]	-------	10.34	5.67	10.09	11.04	8.43	7.37	10.29	9.68	-------
Difference for $P=0.01$	-------	14.11	7.73	13.76	15.06	11.50	10.05	14.04	13.20	-------
AVERAGE INDICATED YIELD OF 96° SUGAR PER ACRE (POUNDS)										
Co. 281	4,306	3,451	3,848	2,138	3,132	3,628	3,097	4,803	3,668	3,563
Co. 290	7,177	4,807	5,145	4,086	3,831	5,544	4,016	6,515	4,590	5,079
C. P. 28/11	6,105	5,190	3,989	3,264	3,567	4,561	3,551	5,187	3,997	4,379
C. P. 28/19	5,936	4,743	5,168	2,210	3,556	4,647	3,239	5,707	4,735	4,438
C. P. 29/116	5,983	4,978	4,388	5,280	3,891	5,155	4,380	5,959	4,200	4,913
C. P. 29/320	6,415	5,001	4,509	4,403	3,848	5,095	4,381	6,322	5,444	5,046
Difference for $P=0.05$ [4]	-------	443	339	516	355	509	410	446	510	-------
Difference for $P=0.01$	-------	604	463	704	484	695	559	609	695	-------

[1] Tons of 2,000 pounds are used in all tests reported in this circular.
[2] Averages based on 12 determinations.
[3] Averages based on 6 determinations.
[4] Difference between any 2 comparable averages. (See discussion under Experimental Methods.)
[5] Average yield of sugar per acre divided by average yield of cane per acre.

C. P. 28/19 has proved to be one of the most valuable varieties ever cultivated in Louisiana, and its widespread substitution for P. O. J. 234 during recent years has undoubtedly been one of the principal factors responsible for placing the sugar industry of the State on its present improved level of productiveness. Its early maturing qualities are clearly shown by the observed yield of 194.5 pounds of sugar per ton of cane in the average of second-stubble tests (table 4) harvested from October 20 to November 2, as compared with averages from C. P. 807, Co. 290, and Co. 281 ranging from 153.1 to 162.4 pounds. A corresponding superiority was maintained in each of six tests at different localities.

Since the introduction of C. P. 28/19 and its general adoption for early milling purposes, the more recently bred variety C. P. 29/320 has been released for commercial culture. Inasmuch as these two varieties will probably compete directly with each other for prominence in the acreage intended for early milling, it is well to consider them in comparison with each other. At the beginning of harvest the two varieties are usually close together in sugar content and occasionally C. P. 29/320 will be slightly higher, but, as previously pointed out

(*6*), the instances observed where C. P. 29/320 showed a sugar content higher than C. P. 28/19 occurred very early in the season and were almost invariably limited to a range definitely below commercial levels. As the season advances, the advantage as to sugar content in favor of C. P. 28/19 usually becomes greater, which is illustrated by the results of tests during 1937. C. P. 28/19 showed an average advantage over C. P. 29/320 in yield of sugar per ton of cane of approximately 5 pounds in second-stubble tests harvested from October 20 to November 2 (table 4), of 14 pounds in first-stubble tests harvested between November 4 and December 20 (table 3), and of 12 pounds in plant-cane tests harvested from November 26 to December 13 (table 2). Thus, as indicated by the above and by previously reported data, while the demonstrated inferiority of C. P. 29/320 to C. P. 28/19 in this regard has been rather consistent, the order of difference, particularly during early harvest, has not been such as to preclude the possibility of using C. P. 29/320 for early milling purposes.

TABLE 3.—*Results of first-stubble variety tests on light soils in Louisiana during 1937*

[Harvested November 4 to December 20, inclusive]

AVERAGE YIELD OF CANE PER ACRE (TONS)

Variety	Houma [1]	Greenwood [1]	Godchaux [1]	Oaklawn [1]	Southwestern Louisiana Institute [1]	Albania [1]	Roland Farm [2]	Alma [1]	Rosewood [2]	Average of 9 stations
Co. 281	25.85	27.18	22.76	16.70	13.44	20.62	15.44	23.90	24.26	21.13
Co. 290	41.24	39.34	35.56	28.86	22.70	38.44	25.80	43.26	36.40	34.62
C. P. 28/11	30.44	30.74	27.16	22.36	18.06	25.90	23.24	32.64	28.84	26.60
C. P. 28/19	29.74	21.72	28.10	19.64	17.46	28.70	13.54	24.84	27.96	23.52
C. P. 29/116	40.01	37.50	29.44	26.34	22.60	34.18	30.04	41.68	-------	-------
C. P. 29/320	34.18	32.76	27.10	23.22	18.60	32.84	23.30	35.60	30.54	28.68
Difference for $P=0.05$ [3]	2.21	2.35	2.61	2.05	2.28	1.82	2.90	2.11	2.90	-------
Difference for $P=0.01$	2.96	3.14	3.48	2.73	3.11	2.43	3.95	2.82	3.96	-------

AVERAGE INDICATED YIELD OF 96° SUGAR PER TON OF CANE (POUNDS)

Co. 281	175.0	200.3	199.0	201.4	211.2	179.2	203.1	186.7	149.4	[4] 187.3
Co. 290	158.7	185.1	193.1	209.4	210.1	160.9	190.9	157.5	153.6	[4] 176.6
C. P. 28/11	202.6	216.1	220.0	222.1	222.1	202.8	220.5	175.8	164.7	[4] 203.1
C. P. 28/19	206.7	237.0	234.3	228.5	235.3	203.9	237.0	214.3	192.9	[4] 218.5
C. P. 29/116	139.6	162.6	174.8	195.6	198.3	162.5	195.6	132.1	-------	-------
C. P. 29/320	204.1	209.1	219.5	219.4	220.4	192.9	212.6	193.6	184.2	[4] 204.5
Difference for $P=0.05$ [3]	---------	5.11	6.45	6.63	11.39	6.79	8.37	5.32	9.02	-------
Difference for $P=0.01$	---------	6.82	8.80	8.86	15.54	9.07	11.42	7.11	12.30	-------

AVERAGE INDICATED YIELD OF 96° SUGAR PER ACRE (POUNDS)

Co. 281	4,524	5,444	4,529	3,363	2,839	3,695	3,136	4,462	3,624	3,957
Co. 290	6,545	7,282	6,867	6,043	4,769	6,185	4,925	6,813	5,591	6,113
C. P. 28/11	6,167	6,643	5,975	4,966	4,011	5,253	5,124	5,738	4,750	5,403
C. P. 28/19	6,147	5,148	6,584	4,488	4,108	5,852	3,209	5,323	5,393	5,139
C. P. 29/116	5,585	6,097	5,146	5,152	4,482	5,554	5,876	5,506	-------	-------
C. P. 29/320	6,976	6,850	5,948	5,094	4,099	6,335	4,954	6,892	5,625	5,864
Difference for $P=0.05$ [3]	---------	479	762	410	435	373	577	458	627	-------
Difference for $P=0.01$	---------	639	1,039	548	593	498	787	612	855	-------

[1] Averages based on 12 determinations.
[2] Averages based on 6 determinations.
[3] Difference between any 2 comparable averages. (See discussion under Experimental Methods.)
[4] Average yield of sugar per acre divided by average yield of cane per acre.

TABLE 4.—*Results of second-stubble variety tests on light soils in Louisiana during 1937*

[Harvested October 20 to November 2, inclusive]

Variety	Houma [1]	Greenwood [1]	Godchaux [1]	Oaklawn [1]	Roland Farm [2]	Alma [1]	Average of 6 stations
AVERAGE YIELD OF CANE PER ACRE (TONS)							
Co. 281	22.49	22.76	19.96	12.64	6.56	8.02	15.40
Co. 290	43.68	35.32	39.74	25.84	13.80	30.44	31.47
C P. 807	36.76	25.96	32.20	22.56	13.20	19.72	25.07
C. P. 28/11	29.26	26.68	26.02	22.80	9.76	17.64	22.03
C. P. 28/19	30.32	22.56	28.70	15.72	7.70	17.96	20.49
C. P. 29/320	32.03	27.86	28.34	20.86	13.76	----------	----------
Difference for $P=0.05$ [3]	6.08	2.05	1.96	2.10	1.91	2.80	----------
Difference for $P=0.01$	8.01	2.74	2.62	2.80	2.61	3.74	----------
AVERAGE INDICATED YIELD OF 96° SUGAR PER TON OF CANE (POUNDS)							
Co. 281	171.6	152.7	159.3	155.9	186.2	161.8	[4] 162.4
Co. 290	164.6	152.5	155.7	175.2	150.8	146.4	[4] 158.0
C. P. 807	147.4	164.8	142.6	177.9	145.8	141.8	[4] 153.1
C. P. 28/11	196.2	177.6	179.3	184.5	184.8	162.3	[4] 181.7
C. P. 28/19	194.8	202.7	181.1	198.8	216.1	191.9	[4] 194.5
C. P. 29/320	203.9	181.5	179.0	194.4	209.3	----------	----------
Difference for $P=0.05$ [3]	----------	6.59	6.57	7.30	12.38	7.00	----------
Difference for $P=0.01$	----------	8.81	8.78	9.75	16.88	9.35	----------
AVERAGE INDICATED YIELD OF 96° SUGAR PER ACRE (POUNDS)							
Co. 281	3,859	3,475	3,180	1,971	1,221	1,298	2,501
Co. 290	7,190	5,386	6,188	4,527	2,081	4,456	4,971
C. P. 807	5,418	4,278	4,592	4,013	1,925	2,796	3,837
C. P. 28/11	5,741	4,738	4,665	4,207	1,804	2,863	4,003
C. P. 28/19	5,906	4,573	5,198	3,125	1,664	3,447	3,985
C. P. 29/320	6,531	5,057	5,073	4,055	2,880	----------	----------
Difference for $P=0.05$ [3]	----------	397	435	429	393	464	----------
Difference for $P=0.01$	----------	531	581	573	536	620	----------

[1] Averages based on 12 determinations.
[2] Averages based on 6 determinations.
[3] Difference between any 2 comparable averages. (See discussion under Experimental Methods.)
[4] Average yield of sugar per acre divided by average yield of cane per acre.

C. P. 29/320 has almost invariably surpassed C. P. 28/19 in yield of cane per acre and usually in yield of sugar per acre. During 1937, average differences as to the latter were 608 pounds in plant-cane tests, 725 pounds in first-stubble tests, and 626 pounds in second-stubble tests—all in favor of C. P. 29/320. In the average of plant-cane, first-stubble, and second-stubble tests on Roland Farm near Erath (tables 2, 3, and 4), where C. P. 28/19 gave very unsatisfactory results, the average difference in favor of C. P. 29/320 was more than 1,300 pounds of sugar per acre.

These differences are sufficiently important to warrant careful consideration. Against them, however, must be weighed the well-known susceptibility of C. P. 29/320 to wind damage (*12*) and its previously mentioned inferior sugar content. According to Abbott (*1*), it is also more susceptible than C. P. 28/19 to red rot, a weakness that has been reflected in occasional gappy stands.

The serious growth failure of C. P. 28/19 in the vicinity of Erath has rendered its general abandonment there in favor of C. P. 29/320 an imminent necessity. In that locality and, to a lesser extent, at other places in the western part of the sugarcane district, fields of C. P. 28/19 show extensive irregular patches where growth is seriously

stunted. In extreme cases the plants die out completely. An examination of affected plants invariably reveals extensive root rot damage. Ingram,[6] in field examinations, found that such plants also showed varying degrees of injury from the sugarcane weevil *Anacentrinus* sp., but he does not believe that the latter could be the primary cause of the growth failure. Rands and Abbott (*10*) report C. P. 28/19 exceedingly susceptible to root rot, especially under wet soil conditions during winter and spring months. The consequences of the root injury are aggravated by unfavorably dry conditions during the growing season, as was the case in the vicinity of Erath during 1936 and 1937. Such a condition is probably rendered additionally serious in that locality because of the extremely compact subsoil, which must greatly interfere with the upward movement of soil moisture.

TABLE 5.—*Average annual results of sugarcane variety tests on light soils in Louisiana during 1935–37*

Variety	Plant cane				First stubble				Second stubble			
	1935	1936	1937	3-year average	1935	1936	1937	3-year average	1935	1936	1937	3-year average
AVERAGE YIELD OF CANE PER ACRE (TONS)												
Co. 281	27.01	26.80	22.16	25.32	22.29	19.01	21.13	20.81	16.09	17.13	15.40	16.21
Co. 290	40.47	40.59	35.34	38.80	34.90	33.22	34.62	34.25	26.39	31.53	31.47	29.80
C. P. 807	31.69	------	------	------	30.68	28.28	------	------	22.37	26.72	25.07	24.72
C. P. 28/11	26.78	26.54	24.48	25.93	27.14	24.92	26.60	26.22	------	25.40	22.03	------
C. P. 28/19	28.37	26.78	23.44	26.20	24.72	22.60	23.52	23.61	18.49	20.84	20.49	19.94
C. P. 29/116	------	------	36.05	------	------	------	32.72	------	------	------	------	------
C. P. 29/320	30.51	30.60	28.46	29.86	------	------	28.68	------	------	------	------	------
AVERAGE INDICATED YIELD OF 96° SUGAR PER TON OF CANE (POUNDS) [1]												
Co. 281	212.0	187.8	160.8	188.5	213.0	195.5	187.3	199.0	182.5	136.1	162.4	159.7
Co. 290	191.3	172.4	143.7	170.2	196.8	185.7	176.6	186.4	177.5	138.1	158.0	156.7
C. P. 807	185.9	------	------	------	185.6	180.5	------	------	158.2	128.0	153.1	145.6
C. P. 28/11	215.8	182.1	178.9	192.7	212.6	199.5	203.1	205.2	------	148.8	181.7	------
C. P. 28/19	239.7	214.0	189.3	215.9	237.0	220.4	218.5	225.6	204.8	167.2	194.5	188.2
C. P. 29/116	------	------	136.3	------	------	------	165.8	------	------	------	------	------
C. P. 29/320	214.8	193.6	177.3	195.6	------	------	204.5	------	------	------	------	------
AVERAGE INDICATED YIELD OF 96° SUGAR PER ACRE (POUNDS)												
Co. 281	5,726	5,034	3,563	4,774	4,748	3,717	3,957	4,141	2,936	2,331	2,501	2,589
Co. 290	7,741	6,996	5,079	6,605	6,870	6,169	6,113	6,384	4,683	4,353	4,971	4,669
C. P. 807	5,890	------	------	------	5,695	5,105	------	------	3,538	3,419	3,837	3,598
C. P. 28/11	5,779	4,832	4,379	4,997	5,770	4,971	5,403	5,381	------	3,779	4,003	------
C. P. 28/19	6,801	5,730	4,438	5,656	5,859	4,982	5,139	5,327	3,786	3,484	3,985	3,752
C. P. 29/116	------	------	4,913	------	------	------	5,425	------	------	------	------	------
C. P. 29/320	6,553	5,923	5,046	5,841	------	------	5,864	------	------	------	------	------

[1] Average yield of sugar per acre divided by average yield of cane per acre.

Confirming tests during previous years, Co. 290 continued to be the most productive in yield of sugar per acre of any of the varieties that have thus far been extensively tested. Its relatively late-maturing qualities, its lack of entirely satisfactory windrowing qualities (*9*), and its susceptibility to freeze injury, especially when frozen in a relatively immature condition, are the important factors that have

[6] Unpublished notes by J. W. Ingram, entomologist, Division of Cereal and Forage Insect Investigations, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

prevented its more extensive cultivation on the lighter soils in Louisiana. As mentioned in a previous report (*4*), however, this variety has usually shown very satisfactory ripening qualities in the western part of the sugarcane district and in that section is being very satisfactorily cultivated on soils of the lighter type. However, for some reasons not yet satisfactorily explained, Co. 290 has proved to be one of the most susceptible varieties to drought injury among those now in cultivation, and under conditions of inadequate rainfall prevailing in that section during the late spring and summer of 1937 its growth was greatly retarded, a condition presumed to be chiefly responsible for the low sugar content observed in some of the tests there. For instance, in the first-stubble test on Albania Plantation (table 3), Co. 290 produced 160.9 pounds of sugar per ton of cane, as compared with yields of 214.1 and 201.9 pounds, respectively, in tests during 1935 and 1936 harvested during the corresponding period (unpublished). In a second-stubble test on Roland Farm (table 4), Co. 290 yielded at the rate of 150.8 pounds of sugar per ton of cane, as compared with corresponding 1935 and 1936 yields of 199.8 and 191.8 pounds, respectively (also unpublished). More nearly normal yields were obtained in other tests of Co. 290 in that section during 1937.

C. P. 28/11, in spite of somewhat superior stubbling qualities, gave an average yield of sugar per acre lower than that from C. P. 28/19 in the total of plant cane and first and second stubble for the period 1935–37. In less extensive comparisons during the same period, C. P. 28/11 proved somewhat inferior to C. P. 29/320 in yield of sugar per ton of cane and distinctly inferior to the latter in yield of sugar per acre. These results in the light of other well-known unfavorable qualities of C. P. 28/11, especially susceptibility to wind damage as shown by studies reported by Stokes (*12*) and confirmed by widespread plantation experiences, would seem to justify the conclusion that this variety cannot under present conditions be advantageously cultivated on light soils in competition with C. P. 28/19 and C. P. 29/320. In addition, the juices from this variety, on a comparable basis, are exceptionally high in ash (*8*).

C. P. 29/116 produced yields of cane per acre closely similar to those from Co. 290, with rather consistently lower yields of sugar per ton of cane. In line with recommendations made at the time of its release, an extensive substitution of this variety for Co. 290 does not seem justified at present levels of varietal productiveness, but C. P. 29/116 may well be regarded as a possible substitute in the event of a future change in yield trends.

TESTS ON HEAVY SOIL

C. P. 29/116 in tests on heavy soils conducted during 1937 (tables 6 and 7) again proved inferior to Co. 290. The difference of 1.37 tons of cane per acre in favor of C. P. 29/116 observed in the average of plant-cane tests is of doubtful significance and was more than offset by an average difference of 12.5 pounds of sugar per ton of cane in favor of Co. 290. In the one first-stubble test conducted (table 7), C. P. 29/116 was lower than Co. 290 in yield of cane per acre as well as in yield of sugar per ton of cane.

TABLE 6.—*Results of plant-cane variety tests on heavy soils in Louisiana during 1937*

[Harvested November 26 to December 16, inclusive]

Variety	Houma	Godchaux	Oaklawn	Alma	Average of 4 stations
AVERAGE [1] YIELD OF CANE PER ACRE (TONS)					
Co. 290	30.65	39.12	22.24	26.96	29.74
C. P. 807	22.63	28.16	10.56	16.16	19.38
C. P. 28/11	21.45	24.00	18.40	22.32	21.54
C. P. 28/19	15.48	29.76	13.84	13.52	18.15
C. P. 29/116	26.44	38.72	26.08	33.20	31.11
Difference for $P=0.05$	2.22	3.08	2.81	3.33	--------
Difference for $P=0.01$	3.12	4.31	3.93	4.67	--------
AVERAGE INDICATED YIELD OF 96° SUGAR PER TON OF CANE (POUNDS)					
Co. 290	179.8	146.0	167.6	139.3	[2] 157.2
C. P. 807	184.0	151.5	169.4	134.8	[2] 159.9
C. P. 28/11	207.3	186.6	174.5	152.6	[2] 180.4
C. P. 28/19	219.6	181.4	186.8	161.6	[2] 186.9
C. P. 29/116	166.6	118.9	178.6	130.9	[2] 144.7
Difference for $P=0.05$	--------	11.00	9.77	17.30	--------
Difference for $P=0.01$	--------	15.42	13.70	24.26	--------
AVERAGE INDICATED YIELD OF 96° SUGAR PER ACRE (POUNDS)					
Co. 290	5,511	5,712	3,727	3,756	4,676
C. P. 807	4,164	4,266	1,789	2,178	3,099
C. P. 28/11	4,447	4,478	3,211	3,406	3,885
C. P. 28/19	3,399	5,398	2,585	2,185	3,392
C. P. 29/116	4,405	4,604	4,658	4,346	4,503
Difference for $P=0.05$	--------	429	582	748	--------
Difference for $P=0.01$	--------	602	816	1,049	--------

[1] Each average based on 10 determinations.
[2] Average yield of sugar per acre divided by average yield of cane per acre.

TABLE 7.—*Results of stubble variety tests on heavy soils in Louisiana during 1937*

Variety	First stubble [1] (harvested Nov. 3–15)				Second stubble [2] (harvested Oct. 20–29)			
	Houma	Oaklawn	Alma	Average of 3 stations	Houma	Raceland	Alma	Average of 3 stations
AVERAGE YIELD OF CANE PER ACRE (TONS)								
Co. 290	38.52	26.68	38.72	34.64	31.43	21.92	13.60	22.32
C. P. 807	33.00	23.92	24.08	27.00	25.42	17.62	7.84	16.96
C. P. 28/11	27.40	--------	--------	--------	26.41	14.14	5.40	15.32
C. P. 28/19	20.30	14.60	18.68	17.86	21.40	14.12	6.30	13.94
C. P. 29/116	33.34	--------	--------	--------	--------	--------	--------	--------
Difference for $P=0.05$	6.14	4.77	6.34	--------	5.70	1.14	3.92	--------
Difference for $P=0.01$	8.23	7.23	9.60	--------	8.38	1.57	5.42	--------
AVERAGE INDICATED YIELD OF 96° SUGAR PER TON OF CANE (POUNDS)								
Co. 290	176.3	198.4	137.5	167.5	147.3	181.0	144.3	[3] 157.7
C. P. 807	163.2	195.4	141.8	166.4	140.0	161.4	153.0	[3] 149.4
C. P. 28/11	196.4	--------	--------	--------	168.0	196.5	168.7	[3] 176.8
C. P. 28/19	203.9	221.5	176.6	199.2	177.4	202.5	183.4	[3] 186.7
C. P. 29/116	158.1	--------	--------	--------	--------	--------	--------	--------
Difference for $P=0.05$	--------	12.13	17.50	--------	--------	7.04	15.32	--------
Difference for $P=0.01$	--------	18.37	26.52	--------	--------	9.74	21.19	--------
AVERAGE INDICATED YIELD OF 96° SUGAR PER ACRE (POUNDS)								
Co. 290	6,791	5,293	5,324	5,803	4,630	3,968	1,962	3,520
C. P. 807	5,386	4,674	3,415	4,492	3,559	2,844	1,200	2,534
C. P. 28/11	5,381	--------	--------	--------	4,437	2,779	911	2,709
C. P. 28/19	4,139	3,234	3,299	3,557	3,796	2,859	1,155	2,603
C. P. 29/116	5,271	--------	--------	--------	--------	--------	--------	--------
Difference for $P=0.05$	--------	969	575	--------	--------	237	486	--------
Difference for $P=0.01$	--------	1,468	871	--------	--------	328	672	--------

[1] Each average based on 6 determinations.
[2] Each average based on 8 determinations.
[3] Average yield of sugar per acre divided by average yield of cane per acre.

C. P. 807 again gave yields of cane per acre much lower than those obtained from Co. 290, the average difference being 10.36 tons in plant-cane tests (table 6), 7.64 tons in first-stubble tests, and 5.36 tons in second-stubble tests (table 7). The observed yield of sugar per ton of cane was approximately the same for the two varieties in the average of plant-cane and first-stubble tests, but rather definitely in favor of Co. 290 in the average of second-stubble tests. The superiority of Co. 290 to C. P. 807 is also consistently maintained in average yearly results for 1935, 1936, and 1937, summarized in table 8.

TABLE 8.—*Average annual results of sugarcane variety tests on heavy soils in Louisiana during 1935–37*

Variety	Plant cane				First stubble				Second stubble		
	1935	1936	1937	3-year average	1935	1936	1937	3-year average	1936	1937	2-year average
AVERAGE YIELD OF CANE PER ACRE (TONS)											
Co. 290	31.83	32.90	29.74	31.49	36.11	29.13	34.64	33.29	33.39	22.32	27.85
C. P. 807	26.45	24.72	19.38	23.52	31.60	24.42	27.00	27.67	27.57	16.96	22.26
C. P. 28/11	25.39	------	21.54	------	------	22.83	------	------	------	15.32	------
C. P. 28/19	23.55	15.17	18.15	18.96	23.36	19.55	17.86	20.26	21.42	13.94	17.68
C. P. 29/116	------	------	31.11	------	------	------	------	------	------	------	------
AVERAGE INDICATED YIELD OF 96° SUGAR PER TON OF CANE (POUNDS)											
Co. 290	196.3	159.8	157.2	171.3	179.3	192.4	167.5	179.1	134.6	157.7	[1] 143.9
C. P. 807	186.1	157.2	159.9	168.7	173.2	173.2	166.4	171.0	132.9	149.4	[1] 139.2
C. P. 28/11	211.3	------	180.4	------	------	196.3	------	------	------	176.8	------
C. P. 28/19	233.9	187.2	186.9	206.4	222.3	209.1	199.2	211.2	167.4	186.7	[1] 175.0
C. P. 29/116	------	------	144.7	------	------	------	------	------	------	------	------
AVERAGE INDICATED YIELD OF 96° SUGAR PER ACRE (POUNDS)											
Co. 290	6,248	5,258	4,676	5,394	6,476	5,604	5,803	5,961	4,495	3,520	4,007
C. P. 807	4,922	3,885	3,099	3,969	5,472	4,229	4,492	4,731	3,663	2,534	3,098
C. P. 28/11	5,365	------	3,885	------	------	4,482	------	------	------	2,709	------
C. P. 28/19	5,508	2,840	3,392	3,913	5,192	4,087	3,557	4,279	3,585	2,603	3,094
C. P. 29/116	------	------	4,503	------	------	------	------	------	------	------	------

[1] Average yield of sugar per acre divided by average yield of cane per acre.

Average yields of cane per acre obtained from C. P. 28/11 were likewise much below those from Co. 290 and corresponded closely to yields from C. P. 807. In yield of sugar per ton of cane, C. P. 28/11 maintained a significant advantage over Co. 290 in each of the three series of tests (tables 6 and 7), with an average difference slightly exceeding 20 pounds. In spite of the latter advantage, however, C. P. 28/11 was approximately 850 pounds of sugar per acre below Co. 290 in the average of all tests. The above is in good agreement with average results obtained during previous years (table 8).

C. P. 28/19 averaged consistently below C. P. 28/11 in yield of cane per acre and, in spite of its usual advantage in yield of sugar per ton of cane, fell, in general, significantly below the latter in yield of sugar per acre. Thus, from a standpoint of varietal adaptability alone, C. P. 28/19 should preferably be confined to light soils and the better types of mixed soils. As a matter of practical necessity, however, it must often be placed in less favorable soil and drainage situations. As a consequence, many growers have had to resort to the cultivation

of C. P. 28/19 on Sharkey clay and other compact, poorly drained soils. In such situations this variety has given rather unsatisfactory results, especially under unfavorable weather conditions, on account of its susceptibility to root rot. Rands and Abbott (*10*) have advocated summer planting as a possible means of mitigating the effect of root rot damage to this variety. That plant-cane yields from C. P. 28/19 on Sharkey clay, under certain conditions at least, can be greatly improved through early August planting is plainly shown by the results of time-of-planting tests given in table 9. In this instance the average yield of sugar per acre from plots of C. P. 28/19 planted on August 1 was 186.4 percent of the average from those planted on October 1. More or less similar advantages in favor of planting on August 1 were shown by Co. 290 and C. P. 28/11, and a somewhat lesser though quite significant advantage was shown in the case of C. P. 29/116. Although it should be pointed out that the above-mentioned tests were conducted under weather conditions extremely favorable to summer planting, and that a correspondingly great advantage would probably not be maintained over a period of years, the practice would seem to offer much promise for a more satisfactory utilization of these "problem soils" of the Louisiana sugarcane district.

TABLE 9.—*Results of time-of-planting tests with different varieties on Sharkey clay soil at the Houma station*

[Harvested November 18, 1937]

Variety	Planted Aug. 1, 1936			Planted Oct. 1, 1936		
	Yield of cane per acre	Indicated yield of 96° sugar		Yield of cane per acre	Indicated yield of 96° sugar	
		Per ton of cane	Per acre		Per ton of cane	Per acre
	Tons	*Pounds*	*Pounds*	*Tons*	*Pounds*	*Pounds*
Co. 290	51.67	188.2	9,724	34.12	163.9	5,592
C. P. 28/11	32.82	218.0	7,155	21.28	197.2	4,196
C. P. 28/19	28.76	231.2	6,649	17.63	202.3	3,567
C. P. 29/116	33.29	157.3	5,237	24.13	148.6	3,586

TESTS ON MUCK SOIL

Reclaimed marshlands of southern Louisiana consist mainly of clay soils overlain by a layer of muck ranging from a few inches to several feet in depth, with the shallower depths greatly predominating. These soils usually produce very high yields of sugarcane, but their exceedingly high fertility exerts an unfavorable influence on maturity, hence many varieties that are satisfactory on other soils of the sugar district produce cane of exceedingly low sugar content when grown on muck areas. On the other hand, some varieties lacking sufficient vigor and disease resistance to be cultivated successfully on the less fertile soils have, on account of satisfactory maturing qualities, been cultivated with fair success on muck areas. As may be expected, only relatively early maturing varieties have proved of any commercial value under these conditions, a fact that has greatly influenced the assortment of varieties selected for comparative tests. For instance, Co. 290, although a very valuable variety on other soils, has received scant con-

sideration on muck soils in view of its well-known late-maturing qualities.

Confirming previous observations, results of tests near Cut Off during 1937, summarized in table 10, indicate that C. P. 28/19 is the most satisfactory variety now available for Louisiana muck soils.

TABLE 10.—*Results of variety tests on muck soil, Clovelly Plantation, Cut Off, La., during 1937*

Variety	Plant cane (harvested Dec. 20)			First stubble (harvested Dec. 20)			Second stubble (harvested Nov. 2)			Third stubble (harvested Nov. 2)		
	Average yield of cane per acre	Indicated yield of 96° sugar		Average yield of cane per acre	Indicated yield of 96° sugar		Average yield of cane per acre	Indicated yield of 96° sugar		Average yield of cane per acre	Indicated yield of 96° sugar	
		Per ton of cane	Per acre		Per ton of cane	Per acre		Per ton of cane	Per acre		Per ton of cane	Per acre
	Tons	*Lbs.*	*Lbs.*	*Tons*	*Lbs.*	*Lbs.*	*Tons*	*Lbs.*	*Lbs.*	*Tons*	*Lbs.*	*Lbs.*
Co. 281	35.14	(1)	------	24.72	[2] 142.7	3,528	31.00	141.1	4,374	30.49	138.3	4,217
Co. 290	------	------	------	------	------	------	42.74	153.3	6,552	------	------	------
C. P. 28/11	36.56	[3] 145.5	5,319	33.88	154.5	5,234	31.46	167.3	5,263	33.88	168.3	5,702
C. P. 28/19	31.74	[4] 165.4	5,250	32.24	173.8	5,603	28.60	194.9	5,574	28.64	209.2	5,991
C. P. 29/320	36.26	[5] 121.0	4,387	32.40	[3] 168.6	5,463	39.16	172.1	6,739	46.86	168.9	7,915
D-95	17.12	[6] 116.5	1,994	8.10	[7] 127.3	1,031	------	------	------	------	------	------
Difference for $P=0.05$	3.21	------	------	2.78	------	------	4.20	9.3	737	4.57	18.3	930
Difference for $P=0.01$	4.38	------	------	3.90	------	------	5.73	12.7	1,005	6.92	27.7	1,409

[1] All samples too sour for analysis.
[2] 3 out of 5 samples too sour for analysis.
[3] 1 out of 6 samples too sour for analysis.
[4] 2 out of 6 samples too sour for analysis.
[5] 5 out of 6 samples too sour for analysis.
[6] 4 out of 5 samples too sour for analysis.
[7] 1 out of 3 samples too sour for analysis.

Plant-cane and first-stubble tests were harvested approximately 2 weeks after the devastating freeze of December 6 and, as indicated by footnotes, many of the juice samples could not be satisfactorily clarified for sucrose determinations by polarization. Judging from the condition of juice samples at the time of harvest, Co. 281, C. P. 29/320, and D–95 were the varieties most seriously affected. These observations are considered of extreme interest because of the great importance of the freeze problem on muck soils, but it should be pointed out that the poor condition of the juice at harvest rendered sugar yield comparisons much less reliable than under normal conditions.

In each of the four tests C. P. 28/19 proved definitely superior to any of the other varieties in indicated yield of sugar per ton of cane. The early-maturing qualities of C. P. 28/19 when grown on the major soil types in Louisiana are well known. The outstandingly high quality of the cane in these tests, especially in the case of second-stubble and third-stubble tests harvested on November 2, affords additional and rather conclusive evidence of the variety's maturing qualities even when grown under conditions of exceptionally high soil fertility.

In yield of sugar per acre, C. P. 29/320 averaged less than C. P. 28/19 in plant-cane and first-stubble tests but greatly surpassed it in both second- and third-stubble tests and maintained a substantial advantage in this regard in the average of the four tests. But the average yield of sugar per ton of cane from C. P. 29/320 was more

than 28 pounds below that from C. P. 28/19, a disadvantage consistently maintained in the average of previous tests on muck soils (*4*, *6*) and considered of extreme importance under the conditions as previously discussed. C. P. 28/11, in the average of all tests, showed a yield of sugar per ton of cane very similar to that from C. P. 29/320, with a lower average yield of cane per acre.

Co. 290, included in only one of the tests, gave a very high yield of cane per acre, but averaged approximately 40 pounds below C. P. 28/19 in yield of sugar per ton of cane.

Co. 281 and D–95 were below C. P. 29/320 in yield of cane per acre and very much below it in yield of sugar per ton of cane.

PRELIMINARY TESTS WITH NEW SEEDLINGS

Tables 11 and 12 summarize the results of various tests during 1935, 1936, and 1937 with new seedlings, several of which are promising with respect to their windrowing qualities. As indicated in table 11, the data given usually consist of averages of individual tests at several localities.

Among seedlings extensively tested (table 11), C. P. 29/103 and C. P. 29/120 have shown the most promise, but since, according to Lauritzen, Fort, and Balch (*9*), these two varieties are not entirely satisfactory for windrowing purposes, their suitability for commercial culture would depend largely upon their ability to compete with such varieties as Co. 290, C. P. 28/19, or C. P. 29/320 in yield of cane and sugar. In these comparative yield tests and in others previously conducted, both C. P. 29/103 and C. P. 29/120 gave yields of cane per acre much lower than those from Co. 290, a disadvantage for which the observed advantages as to indicated yield of sugar per ton of cane are not considered sufficient to compensate. In plant-cane tests during 1937, C. P. 29/89 and C. P. 29/131 proved inferior to Co. 290 in yield of sugar per ton of cane as well as in yield of cane per acre.

Table 12 gives the results of tests of two seedlings that are considered satisfactory (*9*) for windrowing purposes—C. P. 29/99 and C. P. 29/137—in comparison with Co. 281, whose keeping qualities in windrow are well known. In limited tests during 1936, C. P. 29/99 approximately equaled Co. 281, and C. P. 29/137 surpassed Co. 281, in yield of sugar per ton of cane, and at the same time both showed substantial advantages over Co. 281 as to yield of cane per acre. In plant-cane tests during 1937, C. P. 29/99 and C. P. 29/137 surpassed Co. 281 in yield of cane by approximately the same average differences observed in tests during 1936. In first-stubble tests during 1937, C. P. 29/99 maintained a similar advantage over Co. 281 in this regard, but the yield from C. P. 29/137 was somewhat lower than that from Co. 281. In every test during 1937, both C. P. 29/99 and C. P. 29/137 were lower than Co. 281 in indicated yield of sugar per ton of cane. In a first-stubble test at Houma, C. P. 29/99 was more than 22 pounds below Co. 281 in yield of sugar per ton of cane, but in all other instances the two varieties compared more favorably with Co. 281. In the average (not shown in the table) of the first stubble and of all plant-cane tests both varieties surpass Co. 281 in indicated yield of sugar per acre.

TABLE 11.—*Results of preliminary tests with new varieties in Louisiana during 1935–37*

Variety	Tests during 1935 (plant cane [1])			Tests during 1936						Tests during 1937								
				Plant cane [1]			First stubble [1]			Plant cane [2]			First stubble [1]			Second stubble [1]		
	Average yield of cane per acre	Indicated yield of 96° sugar		Average yield of cane per acre	Indicated yield of 96° sugar		Average yield of cane per acre	Indicated yield of 96° sugar		Average yield of cane per acre	Indicated yield of 96° sugar		Average yield of cane per acre	Indicated yield of 96° sugar		Average yield of cane per acre	Indicated yield of 96° sugar	
		Per ton of cane [3]	Per acre		Per ton of cane [3]	Per acre		Per ton of cane [3]	Per acre		Per ton of cane [3]	Per acre		Per ton of cane [3]	Per acre		Per ton of cane [3]	Per acre
	Tons	*Pounds*	*Pounds*	*Tons*	*Pounds*	*Pounds*	*Tons*	*Pounds*	*Pounds*	*Tons*	*Pounds*	*Pounds*	*Tons*	*Pounds*	*Pounds*	*Tons*	*Pounds*	*Pounds*
Co. 281	27.56	208.4	5,744	29.90	193.4	5,783	21.10	197.4	4,165	22.84	161.9	3,697	22.10	185.4	4,097	17.27	158.3	2,734
Co. 290	43.71	190.6	8,332	45.54	174.9	7,963	37.41	185.7	6,947	36.08	145.1	5,235	39.56	183.1	7,242	31.47	158.0	4,971
C. P. 29/89										33.66	129.2	4,349						
C. P. 29/103	36.15	206.0	7,447	37.45	180.7	6,768	28.52	201.6	5,750				29.06	183.3	5,326	30.69	160.9	4,939
C. P. 29/108				41.00	137.5	5,639							37.03	149.2	5,526			
C. P. 29/116	43.54	181.7	7,912				37.55	177.3	6,659							38.03	143.9	5,474
C. P. 29/120				36.94	178.1	6,578				28.97	158.1	4,580	33.91	194.5	6,594			
C. P. 29/131										30.09	135.8	4,087						

[1] Average of replicated tests at 6 localities.
[2] Average of replicated tests at 8 localities.
[3] Average yield of sugar per acre divided by average yield of cane per acre.

TABLE 12.—*Results of preliminary tests with new varieties promising for windrowing purposes*

Variety	Tests during 1936 (plant cane) [1]			Tests during 1937					
				Plant cane [2]			First stubble [1]		
	Average acre yield of cane	Indicated yield of 96° sugar		Average acre yield of cane	Indicated yield of 96° sugar		Average acre yield of cane	Indicated yield of 96° sugar	
		Per ton of cane	Per acre		Per ton of cane	Per acre		Per ton of cane	Per acre
	Tons	*Pounds*	*Pounds*	*Tons*	*Pounds*	*Pounds*	*Tons*	*Pounds*	*Pounds*
Co. 281	20.13	152.9	3,078	24.99	171.6	4,288	24.42	158.4	3,868
C. P. 29/99	24.36	151.4	3,688	29.91	162.2	4,851	29.98	135.5	4,062
C. P. 29/137	24.63	158.6	3,906	28.76	165.8	4,768	23.65	152.1	3,597

[1] Tests at Houma.
[2] Average of tests at Houma and Alma.

FIBER STUDIES

Table 13 summarizes the result of fiber determinations on samples of sugarcane of different varieties taken at a number of the test fields.

TABLE 13.—*Results of fiber determinations on samples of sugarcane of different varieties from various test fields during 1935–36*

Variety	Fiber content of cane in tests at—							
	Albania	Leon Landry	Erath	Greenwood	Oaklawn	Southwestern Louisiana Institute	Raceland	Average
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
TESTS ON FIRST-STUBBLE CANE DURING 1935								
Co. 281	13.37	13.92	12.92	14.36	-------	-------	-------	13.64
Co. 290	10.92	11.54	10.20	11.29	-------	-------	-------	10.99
C. P. 807	16.05	15.51	15.06	16.45	-------	-------	-------	15.77
C. P. 28/11	15.86	16.57	15.94	16.31	-------	-------	-------	16.17
C. P. 28/19	16.57	17.06	15.68	16.51	-------	-------	-------	16.45
C. P. 29/116	11.73	11.53	11.73	11.50	-------	-------	-------	11.62
C. P. 29/320	15.30	15.48	15.58	15.18	-------	-------	-------	15.38
Average	14.26	14.52	13.87	14.51	-------	-------	-------	14.29
TESTS ON FIRST-STUBBLE CANE DURING 1936								
Co. 281	12.06	-------	11.16	12.23	13.47	10.42	-------	11.87
C. P. 28/11	13.45	-------	13.41	13.79	15.90	14.11	-------	14.13
C. P. 28/19	14.68	-------	12.25	14.16	15.96	12.44	-------	13.90
C. P. 29/320	12.63	-------	13.78	13.61	15.35	13.40	-------	13.75
C. P. 29/116	12.63	-------	10.42	10.84	11.53	10.77	-------	11.24
Average	13.09	-------	12.20	12.93	14.44	12.23	-------	12.98
TESTS ON PLANT CANE DURING 1936								
Co. 281	11.13	-------	-------	-------	-------	-------	11.58	11.35
C. P. 28/11	12.88	-------	-------	-------	-------	-------	13.31	13.09
C. P. 28/19	12.40	-------	-------	-------	-------	-------	13.81	13.10
C. P. 29/320	12.59	-------	-------	-------	-------	-------	10.42	11.50
C. P. 29/116	9.21	-------	-------	-------	-------	-------	10.25	9.73
Average	11.64	-------	-------	-------	-------	-------	11.87	11.75

In spite of wide variations in individual group averages, the different varieties maintained rather similar relationships with one another in regard to fiber content and, as might be expected, fell into groups coinciding very closely with previously mentioned (p. 5) groups made on the basis of juice extraction.

Co. 290 was again the lowest variety studied in the percentage of fiber in 1935, with C. P. 29/116 a close second. Co. 281 was next in order, followed by C. P. 29/320 and C. P. 807, the latter two being very similar in this respect. C. P. 28/11 and C. P. 28/19 were almost invariably the highest two varieties and showed no consistent difference.

VARIATIONS IN YIELD TRENDS

Annual variations in actual yields of cane and sugar per acre observed at the respective test fields and in the average of all tests are to a very large extent due to differences in weather conditions and in the fertility of the land on which the tests are located. For instance, in plant-cane tests at Erath (table 14), the average yearly yields of cane from plant-cane per acre from Co. 281, which has been used as the check variety, ranged from 11.79 to 22.68 tons during the period 1933–37, while corresponding averages for the variety in the average of all light-soil tests ranged from 20.95 to 27.01. Such variations, however, are not to be regarded as necessarily a source of error in measuring the relative yields of varieties in the same test. Through a satisfactory system of plot replication and arrangement, it is possible to subject each variety in any given test to essentially the same soil and other environmental conditions as obtains with every other variety. Quite generally, therefore, in a series of tests so conducted, the yields of a given variety will vary up and down in close correlation with variations in the yield of any other variety, subject, however, to important exceptions. For instance, under excessively dry conditions, a variety susceptible to drought injury may be expected to show a relatively greater drop in yield as compared with normal conditions than a more resistant one. Other and much more important exceptions are cases in which varieties have for some reason or other shown evidence of a definite change in yield capacity in a given locality. As a specific instance of the latter under Louisiana conditions may be cited the case of P. O. J. 213, as stated in a previous publication (*5, p. 26*).

> In plant-cane tests during 1927 and 1928, P. O. J. 213 rather consistently maintained a lead of more than 400 pounds of sugar per acre over the corresponding yield from P. O. J. 234, while during the period 1930–33 annual average yields from P. O. J. 213 were from 300 to 500 pounds below those observed with P. O. J. 234. It is unquestionably significant that the latter period was coincident with the rapid spread of red rot in the variety P. O. J. 213.

The evidence discussed below indicates that retrogressive changes in yield capacity have occurred with at least two other varieties now in commercial cultivation.

Table 14 and figure 1 show that during the period 1933–37 important variations in the relative yields of Co. 281 and C. P. 28/19 occurred at Erath. In plant-cane tests there during 1933, C. P. 28/19 yielded at the rate of 128 percent of the yield of cane per acre obtained from Co. 281; in 1934 its yield dropped to 115.1 percent of the Co. 281 yield; in 1935, to 101.4 percent; in 1936, to 93.4 percent, and in 1937,

to 87.8 percent. During the period, the yield of sugar per acre from C. P. 28/19 dropped from 134.7 to 104.6 percent of that from Co. 281. More or less similar but less gradual drops occurred in the relative yields of cane and sugar per acre from first stubble between 1934 and 1937.

TABLE 14.—*Annual average yields of cane and sugar per acre from Co. 281 and corresponding relative yields from C. P. 28/19, Co. 290, and C. P. 29/320 in tests on light soils in Louisiana during 1933–37*

CO. 281

Year	Plant cane				First stubble			
	Yield of cane per acre		Yield of 96° sugar per acre		Yield of cane per acre		Yield of 96° sugar per acre	
	Average of tests at Erath	Average of all tests in Louisiana	Average of tests at Erath	Average of all tests in Louisiana	Average of tests at Erath	Average of all tests in Louisiana	Average of tests at Erath	Average of all tests in Louisiana
	Tons	*Tons*	*Pounds*	*Pounds*	*Tons*	*Tons*	*Pounds*	*Pounds*
1933	11.79	20.95	2,732	4,569	------	------	------	------
1934	18.46	22.09	4,144	4,374	13.10	17.61	3,111	3,832
1935	22.68	27.01	5,119	5,726	13.80	22.29	3,112	4,748
1936	20.56	26.80	4,301	5,034	13.80	19.01	3,076	3,717
1937	17.16	22.16	3,097	3,563	15.44	21.13	3,136	3,957

C. P. 28/19

Year	Plant cane				First stubble			
	Relative yield of cane per acre [1]		Relative yield of sugar per acre [1]		Relative yield of cane per acre [1]		Relative yield of sugar per acre [1]	
	Average of tests at Erath	Average of all tests in Louisiana	Average of tests at Erath	Average of all tests in Louisiana	Average of tests at Erath	Average of all tests in Louisiana	Average of tests at Erath	Average of all tests in Louisiana
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1933	128.0	115.1	134.7	122.5	------	------	------	------
1934	115.1	112.3	121.0	122.8	119.6	120.0	142.7	133.3
1935	101.4	105.0	118.8	118.8	140.5	110.9	157.2	123.4
1936	93.4	99.9	103.5	113.8	109.3	118.9	139.7	134.6
1937	87.8	105.8	104.6	124.6	87.7	111.3	102.3	129.9

CO. 290

1933	154.5	164.0	154.8	154.8	------	161.2	------	157.5
1934	158.3	157.1	149.4	146.9	174.0	160.6	171.3	154.6
1935	163.1	149.8	143.4	135.2	187.8	156.6	183.2	141.2
1936	137.5	151.5	129.8	139.0	190.3	174.8	174.2	166.0
1937	140.9	159.5	129.7	142.5	167.1	163.8	157.0	154.5

C. P. 29/320

1933	------	------	------	------	------	------	------	------
1934	------	------	------	------	------	------	------	------
1935	114.6	113.0	110.7	114.4	------	------	------	------
1936	106.8	114.2	113.0	117.7	199.7	145.5	208.6	157.3
1937	127.3	128.4	141.5	141.6	150.9	135.7	158.0	148.2

[1] Corresponding yield from Co. 281 taken as 100 percent.

In the average of all tests in Louisiana during the period 1933–37 (table 14), the trend in the relative cane yield of C. P. 28/19 in comparison with Co. 281 was rather definitely downward in the case of plant cane but not conspicuously so in the case of first stubble. In this connection, it may be of considerable significance that in the

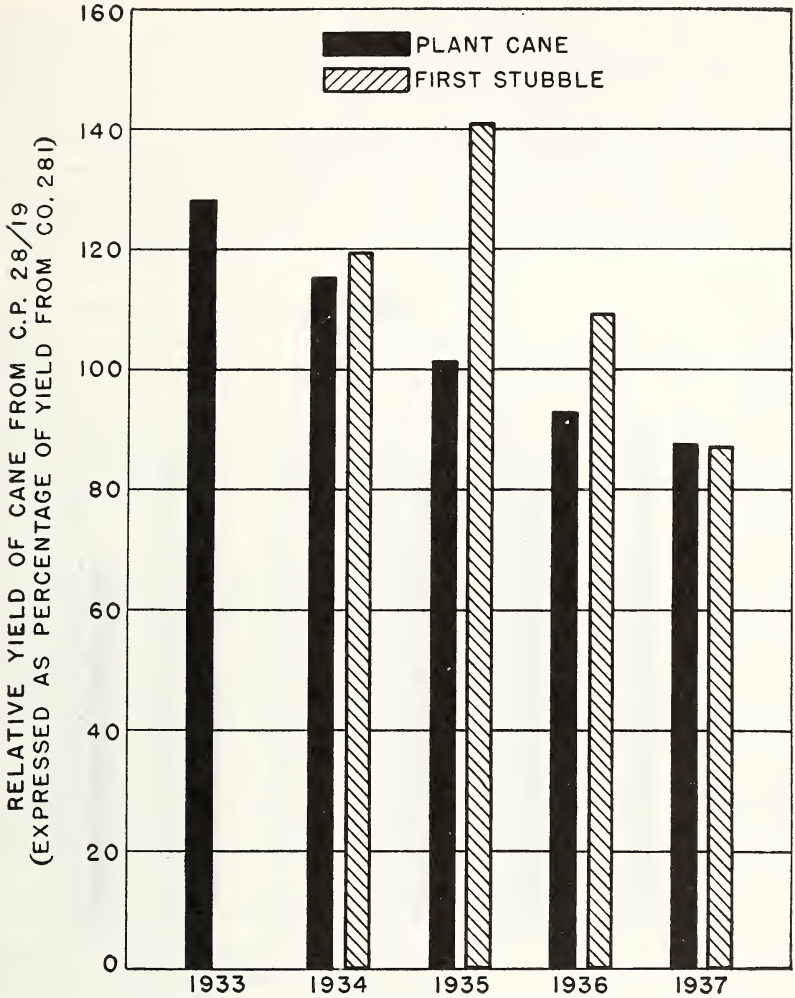


FIGURE 1.—Graphic comparison of annual average yields of cane per acre from C. P. 28/19 and Co. 281 in plant-cane and first-stubble tests at Erath.

average of all plant-cane tests during 1933 and 1934, C. P. 28/19 maintained an average advantage over Co. 281 of more than 13 percent in yield of cane per acre, whereas in the average of tests during the period 1935–37 the corresponding advantage was approximately 3.5 percent.

An examination of relative yields of cane and sugar per acre obtained with Co. 290 during the period 1933–37 and with C. P. 29/320

during 1935–37 (table 14) indicates that these two varieties have at least "held their own" as compared with Co. 281; in fact, in the average of all plant-cane tests in Louisiana, the relative yield of cane per acre from C. P. 29/320 in comparison with Co. 281 shows evidence of an upward trend, but available data extend over too short a period to establish this point definitely.

Table 15 gives the average yields of cane and sugar per acre obtained from Co. 290 in tests on heavy clay soils and also relative yields from C. P. 807 in comparison with those from Co. 290. Average annual yields of cane and sugar from Co. 290 have varied about as may be expected from a consideration of known variations in weather conditions and in the fertility of plots selected for individual experiments. The relative yields obtained from C. P. 807 have, on the other hand, shown a consistent decline from 1932 to 1937, as strikingly shown by results graphically presented in figure 2. In the average of plant-cane

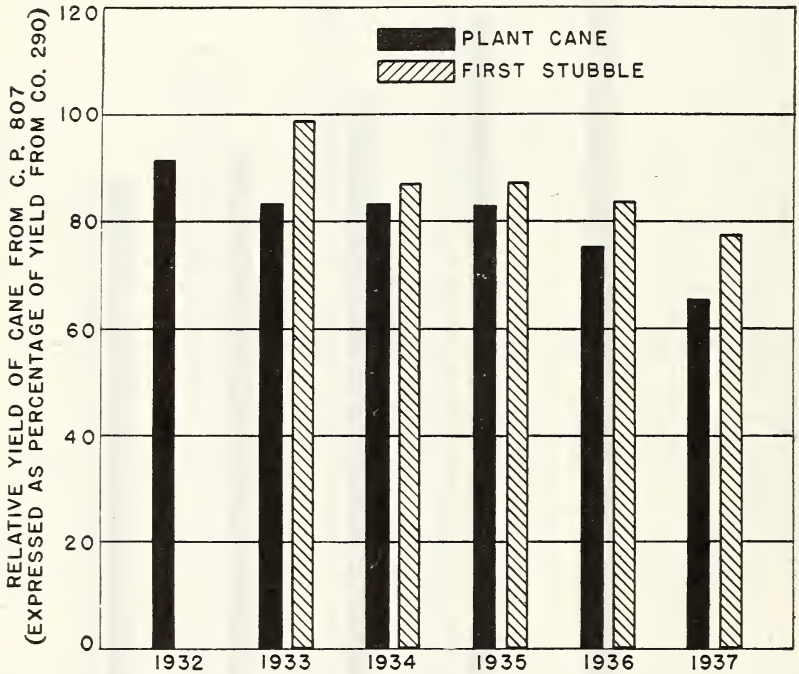


FIGURE 2.—Graphic comparison of annual average yields of cane per acre from C. P. 807 and Co. 290 in plant-cane and first-stubble tests on heavy soils in Louisiana.

tests during 1932, C. P. 807 yielded at the rate of 91.8 percent of the yield of cane per acre obtained from Co. 290, whereas in the average of tests during 1937 the corresponding relative value dropped to 65.2 percent. Values for successive intervening years showed a decided downward trend, although changes during the period 1933–35 were slight and were probably insignificant. There was also a similar trend in the relative yields of sugar per acre in plant-cane tests and likewise in the relative yields of cane and sugar per acre in the average of first stubble during 1933–37.

TABLE 15.—*Comparison of average annual yields obtained from Co. 290 and C. P. 807 in tests on heavy soils in Louisiana during 1932–37*

Crop year	Average yields from Co. 290				Average relative yields from C. P. 807 [1]			
	Cane per acre		Indicated 96° sugar per acre		Cane per acre		Indicated 96° sugar per acre	
	Plant cane	First stubble	Plant cane	First stubble	Plant cane	First stubble	Plant cane	First stubble
	Tons	*Tons*	*Pounds*	*Pounds*	*Percent*	*Percent*	*Percent*	*Percent*
1932	27.49	--------	5,380	--------	91.8	--------	93.4	--------
1933	26.16	29.49	5,578	5,868	83.8	98.4	77.1	87.2
1934	30.62	20.31	5,356	4,440	83.6	86.4	80.5	74.8
1935	31.83	36.11	6,248	6,476	83.1	87.5	78.8	84.5
1936	32.90	29.13	5,258	5,604	75.1	83.8	73.9	75.5
1937	29.74	34.64	4,676	5,803	65.2	77.9	66.3	77.4

[1] Yield from Co. 290 taken as 100 percent.

These rather striking instances of changes in yield trends among varieties raise important questions—(1) as regards the causative factors involved, and (2) as regards the interpretation of the results of yield tests. There is, of course, a possibility—but a very remote one—that changes in observed yields may have been caused by an accidental succession of soil and weather conditions that differentially affected the growth of varieties involved in such a way as to produce the results mentioned. In the absence of any pronounced trend in yearly weather variations during the period involved, and in view of the fact that sites for tests in successive years at individual localities were of the same soil type and of approximately the same fertility, it is believed that factors other than weather are involved.

Abbott (*2*) has found that coincident with widespread changes in sugarcane varieties cultivated in Louisiana there has occurred a marked change in the relative proportions of dark and light races of the red rot fungus (*Colletotrichum falcatum*). This author reports that previous to 1933, isolates of *C. falcatum* obtained from sugarcane in Louisiana consisted almost entirely of light races and that during the period 1933–37 a gradual change in the relative prevalence of the two strains occurred until slightly more than 80 percent of isolates made from Louisiana sources in 1937 belonged to the dark race. He states further that cultures from C. P. 807 were predominantly of the dark race and points out that the increase in the prevalence of this particular strain in Louisiana has coincided with an increase in red rot germination injury to this variety. This strongly suggests that the observed general drop in relative yields from C. P. 807 was brought about as a direct result of progressively greater red rot injury due to the presence of a specifically virulent strain of the causative organism in increasing proportions.

The cause for the observed gradual decline in yield of C. P. 28/19 at Erath discussed on page 19 does not so readily suggest itself, but in view of the rather striking physiological differences between different isolates of *Pythium arrhenomanes* from Louisiana reported by Rands and Dopp (*11*), there would seem to be a possibility at least that there has occurred in this case also a change in the relative prevalence of a specifically harmful organism.

Abbott (*2*) and Rands and Dopp (*11*) have suggested that certain strains of specifically injurious disease organisms may be stimulated to multiply in increasing proportions in response to continued cultivation of varieties that they are able to attack. It should be mentioned here also that the virus responsible for sugarcane mosaic in Louisiana has been demonstrated by Summers (*13*) to consist of a variety of strains that differ materially among themselves as to virulence and symptoms produced on different varieties of sugarcane.

It would seem, therefore, highly important in interpreting the results of sugarcane variety-yield tests to recognize two fundamentally different sorts of variations in the relative performance of varieties from year to year—(1) changes due to random variations in environment (weather, soil differences, etc.), and (2) those that originate from causes that tend to change progressively, and for practical purposes permanently, yield relationships. Variations of the latter sort are, of course, not readily detectable from the results of agronomic tests unless comparative data for a period of years are available and the data preferably supplemented by related pathological studies.

SUMMARY

The results of tests during 1935–37 have again shown that the cultivation of Co. 281 instead of other varieties of more or less similar adaptability, such as C. P. 28/19 and C. P. 29/320, entails an important sacrifice in yield of sugar per acre under conditions where the cane is not windrowed. However, since Co. 281 is the only variety now available for commercial cultivation that has demonstrated satisfactory windrowing qualities, it must necessarily enjoy a more or less preferred status for cultivation on light soil areas.

C. P. 28/19 again demonstrated very satisfactory ripening properties in spite of unfavorable conditions during the fall of 1937. Results of tests during the last few years indicate, however, that relative yields from this variety as compared with Co. 281 have measurably declined. In spite of their apparent decline, the yields from C. P. 28/19 have remained outstandingly superior to those from Co. 281 except in the vicinity of Erath, where C. P. 28/19 in recent years has given extremely unsatisfactory results.

C. P. 29/320, while somewhat inferior to C. P. 28/19 in yield of sugar per ton of cane, has consistently afforded cane of very satisfactory quality and in the average of tests during 1937 outyielded C. P. 28/19 by more than 650 pounds of sugar per acre. In view of its early-maturing qualities, this variety may be regarded as a possible substitute for C. P. 28/19. Its susceptibility to wind damage is considered, however, a serious disadvantage under Louisiana conditions.

Results of tests conducted up to this time demonstrate that, on soils of the lighter type, C. P. 28/11 cannot compete with other varieties now available for cultivation. This variety has shown some promise on heavy clay soils principally on account of resistance to red rot, but several undesirable physical qualities would seem to render undesirable an extensive substitution of it for Co. 290 in such locations.

Co. 290 has proved definitely superior to C. P. 807 for cultivation on heavy clay soils.

C. P. 29/116 gave yields of cane per acre comparing favorably with those from Co. 290, but in line with results of previous tests it proved consistently inferior to the latter in yield of sugar per ton of cane.

C. P. 28/19 again gave, in general, the most satisfactory results in tests on muck soils, but in the average of second- and third-stubble tests it was significantly below C. P. 29/320 in yields of cane and sugar per acre.

Results of preliminary tests with a number of C. P. seedlings selected from the 1929 series indicate that C. P. 29/89, C. P. 29/103, C. P. 29/108, C. P. 29/120, and C. P. 29/131 are less satisfactory than other varieties now available for commercial culture. C. P. 29/99 and C. P. 29/137 have demonstrated satisfactory keeping qualities in windrow (*9*), which is their principal point of merit. In the average of limited tests during 1936 and 1937, each of these two varieties surpassed Co. 281 in yields of cane and sugar per acre but proved somewhat inferior to Co. 281 in yield of sugar per ton of cane. However, definite conclusions as to the suitability of C. P. 29/99 and C. P. 29/137 for commercial culture will depend on the results of more extensive tests.

An analysis of comparative yields of cane from different varieties over a period of years indicates that retrogressive changes in relative yield capacity of varieties, which in at least one of the instances cited appear to have been definitely related to a change in the pathological environment, should be carefully considered in interpreting the results of sugarcane variety tests.

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